

## INDIGENOUS METHOD TO COMBAT ENVIRONMENTAL HEALTH HAZARDS OF AGRICULTURAL WORKERS WHILE HARVESTING

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### ABSTRACT

*While conducting different agricultural operations, farmers face major difficulty with dirt, dust and organic or other substrates, which obstructs or hinders their regular activity. From the first hand information, by conducting surveys, primary data were collected from the selected villages near Ranga Reddy district Hyderabad, Telangana. Cuts in hands, sever finger wounds, piercing of thorns and kellicks, etc were found in harvesting Okra, Cotton, Chilli, Sugarcane crops and cutting of Castor, Fodder, and weed. This was only due to minimal care taken by the farmer workers.*

*To overcome these difficulties, present study was under taken to design and develop a functional clothing kit includes, Apron, Knitted gloves and Scarf. Developed functional clothing was assessed against existing practice for its suitability, comfortability and durability. From the analysis, the acceptance level of the functional clothing by farm workers was found to be very good without obstructing their farm activities.*

**KEYWORDS:** Agricultural Workers, Occupational Health Hazards & Protective Clothing

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### INTRODUCTION

As agriculture being one major occupation in India, hence the largest number of workers, around 58.4 percent of the population is involved in Agricultural activities, Punam Rani, *et. al*, 2013. In India, around 75 percent of rural women are involved in agricultural activities like weeding, grading, threshing, winnowing, cleaning, harvesting, etc., (Singh Divya, Vinay Deepa. 2013). Continuous exposure and working conditions in these areas will adversely affect their health. In U.S., during 1987 death rates in agriculture became the most hazardous occupation (Department of Labour, 1988). Prolonged exposure to pesticides, organic dust, sun or any other obstructing matter, while farm activities, can cause health risk to the workers.

The hazards can be addressed by the specially designed or developed or modified protective clothing. Protective clothing refers to traditional categories, where items such as pads, guards, shields, or masks, etc., are termed as protective gears ([https://en.wikipedia.org/wiki/Personal\\_protective\\_equipment](https://en.wikipedia.org/wiki/Personal_protective_equipment)). They can safeguard from physical, electrical, heat, chemicals, biohazards and airborne matters, which may be worn for job related purposes, as well for sports and recreation activities, accordingly. Each item with protective attribute must be compared expected hazards found at the workplace. Protective clothing/equipment with more breathability may serves as greater user satisfaction, but can lead to higher contaminations (Verbeek Jos H *et al*, 2016).

According to Desai (2006), safety and protective clothing mean any fabric related items specially designed, depend on the need to protect the wearer from hazardous environment, whose effect may lead to injury or death. Occupational skin diseases are one of the most common type of diseases occurred mainly due to chemical agents, physical agent, biological agents or mechanical traumas, etc., have varying ill effects when exposed to skin (Centers for Disease Control and Prevention, 2012). These hazards may be simple minor dermatitis, or severe one leading to poisoning and cancer (Parthiban and Ramesh Kumar, 2007). Unstable economic conditions or poverty line of the workers is increasing their exposure to various environmental hazard (House J S, et. al., 1990 and Williams, 1990), which can influence the health risk of person as an individual or as group as whole (P.Lavanya Kumari and K.Giridhar Reddy, 2013).

Increased health and safety measures at work places have raised the researcher's or scientist's or extension worker's, focus towards the potential development of protective clothing, considering and evaluating the consequences related hazards (Parthiban and Ramesh Kumar, 2007). To overcome farm workers, hazardous experience, functional clothing kit was developed to bring safety measures in an economical way.

## **METHODS AND MATERIALS**

### **Stage I**

On stage I, subjects were selected and were checked for hazardous levels faced by them through a questionnaire called the pre schedule questionnaire. General information like name, age, qualification, income status, family type along with their difficulty at work area was recorded.


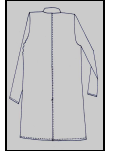
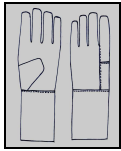

30 farmers and farm women were selected from the Rangareddy district, Hyderabad, Telangana, India to know the problems, while doing farming activities in Okra, Cotton, Castor and Fodder fields. Pre schedule questionnaire was developed to know the problems encountered and to check the hazardous level faced by farm workers while attending to different farm activities. After close vision and understanding farm workers difficulty while working in the fields through developing pre-schedule questionnaire, functional clothing was designed.

### **Stage II**

#### **Designing of Functional Clothing for Agriculture Workers**

After completion of the pilot study, garments and accessories were designed and developed depend on the requirement of the farmers/farm women to perform different farm activities safely. Parameters like, construction details, design features and material used required for designing of functional clothing were depicted in Table 1, along with measurements in Table 2.

**Table 1: Designed Functional Clothing**

Parameters	Apron	Gloves Woven	Knitted	Scarf
<b>Construction details</b>	The apron was stitched by using the basic sewing method, where as the sleeves were constructed with lapped seam	Consists of two pieces, which were joined with lapped seams at wrist level.	Constructed by circular knitting method from Krishna Kishore Knitting Industry, Pathan Cheru, and Hyderabad.	Plain woven fabric
<b>Design features</b>	<ul style="list-style-type: none"> <li>▪ Full length sleeves</li> <li>▪ Front placket</li> <li>▪ Slit at back</li> <li>▪ Shawl collar</li> <li>▪ 3 Pockets one above and 2 below</li> </ul>	<ul style="list-style-type: none"> <li>▪ Thumb, finger was inserted separately for better insertion</li> <li>▪ Specially designed to suit right and left hands independently</li> </ul>	<ul style="list-style-type: none"> <li>▪ One knit and one purl stitch was used for finger and palm area</li> <li>▪ Wrist area with 2X1rib stitch.</li> <li>▪ Wales and courses in palm area is 12:10</li> <li>▪ Over locking at wrist hemline.</li> <li>▪ Suitable to wear on any hand</li> <li>▪ Has good stretch ability with compact fitting</li> </ul>	Wrapped around the head through draping method
<b>Material used</b>	P/C blend	Kora/gray cloth	Cotton yarn 80s.	Rayon
<b>Cost (INR)</b>	325.00	25.00	35.00 to 45.00	80.00
<b>Designed figures</b>	 			Note: commercially available P/C blend scarf was compared with normal towel.

### Suitability Assessment of the Functional Clothing by Experts

Developed functional clothing were tested for their suitability by 30 (its better if we code 10 experts, I think. Otherwise, whatever you say) experts from the clothing & textiles Department, College of Home Science, Hyderabad. The suitability assessment was done by comparing control with developed garments in term of its appearance/style, color, size, fit/drape, fabric quality, construction quality and cost efficiency on a five quantum scale [Very good (5), good (4), moderately good (3), less good (2), not good (1)], with the relevant developed questionnaire. Weighted Mean Scores are calculated for each suitability variable and garment.

### Stage III

#### Field Trials

Developed functional clothing was assessed for its performance, as well compared with the control subject like the apron was assessed against old (P/C blend) shirt, scarf against old towel, and bare hands against different types of gloves.

## RESULTS AND DISCUSSIONS

### Stage I

#### Questionnaire for Assessing Functional Clothing

Study subject was collected from Nagireddy Guda, Ketireddy palli and Eithbar palli, Moinabad Mandal, Ranga Reddy District, Hyderabad, and Telangana, India. They fall in the age group of 22-55, with minimal qualification levels. Most of the families are nuclear and joint families having income range from Rs. 10,000/- to Rs.15, 000/-.

When surveyed, the following problems were found to be prominent during farm activities:

#### Regular Problems Faced During Farming

There was sever soiling of hair and face during land preparation was observed, where hands get soiled irrigation, weeding and pesticide/fertilizer application. Eye irritation and itching during seed treatment and weeding was found to 100 per cent, where for pesticide/fertilizer application and land preparation 80 and 60 per cent respectively, was observed.

100 percent respondents felt skin allergies/rashes on face, hands and legs during weeding and pesticide/fertilizer spraying, where for seed treatment 50 – 70 per cent respondents felt allergic. As the farming involves laborious and most complex processes, around 25 to 50 percent also felt nausea, vomiting, giddiness and headache during seed treatment and pesticide/fertilizer application.

#### Specific Problems Occurred During Farming

From the survey, the major problems encountered by the farm workers were also observed. This includes severe back and shoulder ache during sowing (70-85 per cent); deep cuts while harvesting, sowing and weeding.

Harvesting is done mostly by farm women. No protecting or care was ensured while harvesting. As they are harvested with bare hands, 80 percent of women have complained about the problem with castor spikes/ cotton kellicks / okra and brinjal thorns/chili peduncle, they end up with cuts, burns, pricks, finger wounds, etc., in the hands. With these problems farm women are not able to attend to their household chore, if attending, with great difficulty they are able to do their household activities.

Apart from these, farm women also facing few problems like running nose, breathlessness, swelling (60-70) and paining toes (90), fungal infection (20), etc.,. 100 per cent people mentioned severe tanning with longer period exposures in sunlight.

After thorough study, following problems were identified in a few fields along with other common problems like skin rashes, eye irritation, sever tanning, etc.,.

Table 2: Problems Encountered During Harvesting in Different Fields

Parameters	Cotton	Okra	Castor	Chilli	Sugarcane	Fodder Cutting
<b>Problems identified</b>	<ul style="list-style-type: none"> <li>Dried kellicks obstructing while harvesting.</li> <li>Finger woods</li> <li>Eye irritation/ itching, running nose and breathlessness</li> </ul>	<ul style="list-style-type: none"> <li>Thorns piercing while harvesting</li> <li><b>Cut in hands, hindered and paining</b></li> <li>Severe finger wounds</li> </ul>	<ul style="list-style-type: none"> <li>Painful to hold castor stalk while harvesting due to thorns</li> </ul>	<ul style="list-style-type: none"> <li>Fingers become burnt after harvesting</li> <li>Burning sensation</li> <li>Finger tips slightly crackled</li> </ul>	<ul style="list-style-type: none"> <li>Sugarcane leaf edges remains cut marks on hands while harvesting</li> </ul>	<ul style="list-style-type: none"> <li>Difficulty in cutting due to sharp edges of the fodder</li> </ul>

### Existing Dress Pattern of Male and Female Farm Workers





From the survey, existing clothing practices of farm workers in the farm activities were also observed. Men wear shirt and lungi in the activities performed, where occasionally they wear chappal to protect their feet, but never taken care of hands and face. Farm women wear sari and blouse; they don't even wear chappal or any means of protection at working condition. Few women wear an old shirt on sari along with an old towel on head for protection from the sun.

### Stage II

#### Designed Functional Clothing

After a successful collection of problems encountering farm workers, functional clothing was designed, so, as to reduce and the farm workers from different occupational hazards. The details of the developed functional clothing kit were given in table 3.

Table 3: Measurements for Functional Clothing

Required Measurements	Apron measurements Measurements Inches	Gloves Measurements Measurements Inches	Scarf Measurements (Inches)
	Woven Knitted	Woven Knitted	
	Total length 36 Shoulder 17 Chest circumference 45 Waist circumference 40 Hem circumference 48 Placket length 22 1/2 Upper pocket length 5 1/2 Upper pocket width 5 Lower pocket length 7 Lower pocket width 5 1/2 Back slit length 6 Sleeve 6 Total length 28 Bicep circumference 17 Elbow circumference 15 1/2 Hem circumference 15	Total length 11 9 Palm maximum circumference 12 10 Wrist circumference 9.5 8 1/2 Hem circumference 10 8 1/2 Finger length 3 Thumb length 2 1/2 2 1/2 Forefinger length 3 2 1/2 Middle finger length 3 1/2 3 Ring finger length 3 2 1/2 Small finger length 2 1/2 2	Length 78 Width 37
End products	 Apron	 Woven Gloves  Knitted Gloves	 Scarf

### Suitability Assessment of the Functional Clothing by Experts

Experts' rating on the suitability of the functional clothing was depicted in table 4, in compiled form of Weighted Mean Scores (WMS).

**Table 4: Suitability Assessment of the Functional Clothing by Experts in WMS (N=10)**

Type of Garment		Appearance /Style / Feel	Color	Size	Fit / Drape	Fabric Quality	Construction Quality	Cost Effectiveness
Upper garment	Old shirt	1.83	1.83	2.66	2.66	1.73	1.73	3.9
	Apron	4.93	5	3.83	3.83	5	5	3.2
Gloves	Woven	3.93	3.93	2.06	2.93	5	4.1	2.96
	Knitted	5	5	5	5	5	5	5
Head gear	Towel	2.3	2.4	2.4	2.46	2.06	-	4.93
	Scarf	2.83	3.83	4.53	4.2	4.33	-	4.4
Mouth mask		4.93	4.93	3.4	4.4	4.93	4.93	4.33

From the available data it is clearly evident that the designed and developed protective clothing can give good support and protection to the agriculture and allied sector workers while working in the fields. The designed and developed functional clothing can gain imperative role in the farm and allied workers.

From the experts view the appearance, size, fit and style of the apron is more outstanding than the controlled (old shirt) once, where as color, fabric and construction quality have ranked 100% approval. Only drawback is with the cost effectiveness, i.e., apron costs more than the old shirt, as farm workers would like to spend at least as possible in their investments, but it can be overviewed before all the advantages that apron has.

When compared with woven gloves, knitted gloves were rated highly with WMS of 5 by the experts in terms of feel and grip. The scarf was found to be good head protection than a commonly used towel. It protects from the sun and dust with good drape. From the data, it was noticed that the framework of the muffs was intact and it provides protection from noise pollution.

### Stage III

#### Wear trails in fields (Okra, Cotton, Castor and Fodder fields)

Wear trails of developed functional clothing were done on 30 farm women workers and asked to wear while harvesting. Each member has done 5 wear trails and post data was collected after the fifth trail was done. The data were collected on the basis of five quantum scale, with the relevant developed questionnaire, to elicit information on Suitability, Comfortability, and adoption feasibility by the farm workers.



**Figure 1a: Control**



Figure 1b: Wear Trials of Functional Clothing in Cotton and Okra Fields

Table 5: Acceptability of the Functional Clothing by the Farm Workers

(WMS = Weighted Mean Scores) N=30(100%)

S. No.	Functional Features of Garments/Accessories	Characteristics of Functional Features	Weighted Mean Scores (WMS)						
			Upper Garment		Gloves			Head Protection	
			Old Shirt	Apron	Woven	Knitted	Latex Coated	Towel	Scarf
1.	<b>Suitability assessment</b>								
a.	Appearance	Superior	3.6	4.6	2.86	4.93	4.8	1.93	4.06
b.	Length of the garment/accessory	Sufficient	2.4	4.2	2.96	4.8	4.76	2.53	4.66
c.	Size and shape of the garment/accessory	Appropriate	2.0	4.2	3.0	5	4.76	2.26	4.86
d.	Size and shape of collar	Appropriate	2.13	4.83	-	-	-	-	-
e.	Size of sleeves and cuffs	Appropriate	2.13	4.63	-	-	-	-	-
f.	Size and placement of Pockets	Convenient	1	3.83	-	-	-	-	-
g.	Placket opening & fasteners of the garment	Suitable	1.66	4.06	-	-	-	-	-
h.	Fit/grip of the garment/accessory		-	-	1.26	5	4.76	-	-
2.	<b>Comfortability assessment</b>								
a.	Easy to wear/drape		2.73	5.0	3.13	5	4.93	3.86	4.2
b.	Easy to remove		2.73	5.0	3.13	5	4.93	3.86	4.4
c.	Grip/comfort while working		-	-	1.4	5	4.66	2.66	4.4
d.	How long can be worn	More than 3hrs	1	4.1	2.4	5	2.53	0	4.46
e.	Fabric	Protects body from external matters	1.33	4.46	2.4	5	3.46	2.7	4.9
		Absorbency of perspiration	1.53	4.5	3.5	5	2.0	3.26	4.86
3.	<b>Durability/serviceability</b>	Entire crop period	2.6	5.0	4.46	4.93	4.0	5.0	4.93
4.	<b>Adoption feasibility</b>	Cost of the garment	5.0	4.1	4.83	4.93	3.16	5.0	4.73



After assessing each garment and accessory by five point quantum scale, compiled weighted mean score (WMS) were depicted in the table 5. Which revealed that, Apron has scored highest WMS (3.6) for its appearance; comfort and durability have secured around 4.5 and 5.0 respectively, where old shirt has scored below 2.5 WMS except cost effectiveness which scored 5.0. Among gloves, knitted gloves have scored highest WMS with 5.0 in all the parameters like suitability, comfortability, durability and cost effectiveness. However, knitted gloves took little time for adjustment initially for at least one to three trials, but were accepted mainly due to for its intact grip, which make the worker feel light-handed while working and also allow the worker to work without affecting their work efficiency as well protecting the workers palm and finger.

Compared to control (towel), the scarf has scored around 3.9 WMS for its comfort, protection from external matters. From this study, it was found that, the acceptance of functional kit with the old shirt as upper garment; knitted gloves as protection for palms; and scarf/old towel as protection from the sun and dust was good. Among which Knitted gloves have got good response.

**Important note:** After successful trials, the functional clothing kit was up-scaled and was given to farm workers for interventions through KVKs for harvesting Okra, Cotton picking, Sugar cane cutting, Chilli plucking, Castor, Fodder, and Weed cutting. From the interventions, it was observed that the farm workers' willingness towards wearing functional clothing has been increased during farm activities.



**Figure 2: Intervention in Harvesting/Cutting of Okra, Cotton, Fodder, Castor, Chill and Weed**

## CONCLUSIONS

Prolonged exposure to pesticides, organic dust, sun or any other obstructing matter, while farm activities, can cause health risk to the workers and are the most important occupational risks among small and marginal farmers. To overcome their occupational health hazards, designed and tested functional/protective clothing/accessories were designed and tested for their suitability and acceptability and given for wear trials, which reduced occupational hazards and of the wearer with effective adaptation levels, without disturbing their work efficiency.

From this study it can be concluded that farm workers have gained benefits using functional clothing kit in terms of:

- Easy to wear and easy to remove, very comfortable for working with good absorbency.



- Protects hands and palm from the injuries caused during plucking while harvesting
- Speeding up the activity due to comfort grip.
- Workers expressed happiness attending the household activities.

With an increased awareness for functional clothing, now farm workers are showing increased demand in adopting functional clothing kit.

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